What is claimed is:

1. A capacitor of a semiconductor device comprising:

a capacitor lower electrode disposed a semiconductor substrate;

a first dielectric layer comprising aluminum oxide disposed on the capacitor lower electrode;

a second dielectric layer comprising a material having a higher dielectric constant than that of aluminum oxide disposed on the first dielectric layer;

a third dielectric layer comprising aluminum oxide disposed on the second dielectric layer; and

a capacitor upper electrode disposed on the third dielectric layer.

2. The capacitor of claim 1, wherein the second dielectric layer is formed of a material having a dielectric constant of 20 or higher.

3. The capacitor of claim 1, wherein the second dielectric layer is formed of one selected from the group consisting of a Ta_2O_5 layer, a Ti-doped Ta_2O_5 layer, a TaO_xN_y layer, a HfO_2 layer, a ZrO_2 layer, a Pr_2O_3 layer, a La_2O_3 layer, a $SrTiO_3$(STO) layer, a (Ba, Sr)TiO_3(BST) layer, a $PbTiO_3$ layer, a Pb(Zr, Ti)O_3(PZT) layer, a $SrBi_2Ta_2O_9$(SBT) layer, (Pb, La)(Zr, Ti)O_3 layer, and a $BaTiO_3$(BTO) layer, and combinations thereof.

4. The capacitor of claim 1, wherein the second dielectric layer is formed to have a greater thickness than the first dielectric layer or the third dielectric layer.

5. The capacitor of claim 1, wherein the thickness of the first dielectric layer or the third dielectric layer ranges from about 30 Å to about 300 Å.

6. The capacitor of claim 1, wherein the thickness of the second dielectric layer ranges from about 100 Å to about 1000 Å.

7. The capacitor of claim 1, wherein the capacitor lower electrode or the capacitor upper electrode is formed of one selected from the group consisting of a doped polysilicon, a metal such as W, Pt, Ru, and Ir, a conductive metal nitride such as TiN, TaN, and WN, and a conductive metal oxide such as RuO_2 and IrO_2, and combinations thereof.

8. A method for manufacturing a capacitor of a semiconductor device, the method comprising:

forming a capacitor lower electrode on a semiconductor substrate;

forming a first dielectric layer comprising aluminum oxide on the capacitor lower electrode;

forming a second dielectric layer comprising a material having a higher dielectric constant than aluminum oxide on the first dielectric layer;

forming a third dielectric layer comprising aluminum oxide on the second dielectric layer; and

forming a capacitor upper electrode on the third dielectric layer.

9. The method of claim 8, wherein the second dielectric layer is formed of a material having a dielectric constant of 20 or higher.

10. The method as claim in claim 8, wherein the second dielectric layer is formed of one selected from the group consisting of a Ta_2O_5 layer, a Ti-doped Ta_2O_5 layer, a TaO_xN_y layer, a HfO_2 layer, a ZrO_2 layer, a Pr_2O_3 layer, a La_2O_3 layer, a $SrTiO_3$(STO) layer, a (Ba, Sr)TiO_3(BST) layer, a $PbTiO_3$ layer, a Pb(Zr, Ti)O_3(PZT) layer, a $SrBi_2Ta_2O_9$(SBT) layer, (Pb, La)(Zr, Ti)O_3 layer, and a $BaTiO_3$(BTO) layer, and any combination thereof.

11. The method of claim 8, wherein the second dielectric layer is formed to be thicker than the first dielectric layer or the third dielectric layer.

12. The method of claim 8, wherein the second dielectric layer is formed to a thickness of about 100 Å to about 1000 Å.

13. The method of claim 8, further comprising performing a thermal treatment on the second dielectric layer after forming the second dielectric layer.

14. The method of claim 13, wherein the thermal treatment is carried out in an atmosphere containing oxygen.

15. The method of claim 14, wherein the thermal treatment is carried out in an atmosphere of O_3 gas, O_2 plasma gas, or N_2O plasma gas.

16. The method of claim 14, wherein the thermal treatment is carried out at a temperature of about 300 °C to about 500 °C.

17. The method of claim 8, wherein the first dielectric layer or the third dielectric layer is formed to a thickness of about 30 Å to about 300 Å.

18. The method of claim 8, wherein the first dielectric layer or the third dielectric layer is formed using a gas containing oxygen without hydrogen as a reactant gas.

19. The method of claim 18, wherein the reactant gas includes either O_3 gas or O_2 plasma gas.

20. The method as claim in claim 8, wherein the capacitor lower electrode or the capacitor upper electrode is formed of one selected from the group consisting of a doped polysilicon, a metal such as W, Pt, Ru, and Ir, a conductive metal nitride such as TiN, TaN, and WN, and a conductive metal oxide such as RuO_2 and IrO_2, and any combination thereof.

21. The method of claim 20, wherein the capacitor lower electrode or the capacitor upper electrode is formed at a temperature of about 25 to about 500°C.

22. The method of claim 8, wherein the capacitor lower electrode or the capacitor upper electrode is formed using physical vapor deposition, atomic layer deposition, or metal organic chemical vapor deposition.